Exploring Meteorite Mysteries
Lesson 3 — Searching for Meteorites

“Where do they come from?”

Objectives

Students will:

- perform a demonstration of meteorite impacts with water balloons.
- assess various terrains for meteorite recovery using geography skills.
- attempt to recover simulated meteorite fragments.
- make experimental predictions.
- graph experimental results and draw conclusions.

Background

Finding meteorites is quite difficult because most meteorites look like Earth rocks to the casual or untrained eye. Even to the trained eye, recognizing meteorites can be difficult. In many cases meteorites break apart into many fragments as they pass through the atmosphere or impact the Earth. These smaller fragments are harder to find than one large meteorite. Meteorites are rarely found in forests or fields, where they become lost or buried among the plants. In rocky areas, meteorites are hard to find because they tend to be dull black, gray or white, and do not stand out among the much more common Earth rocks (see Meteorite Sample Disk if available). Iron meteorites are the exception. There are few natural sources of metal except meteorites. Old iron implements can be (and often are) mis-taken for meteorites. In many cases, a chemical analysis is required to distinguish a meteorite from an Earth rock.

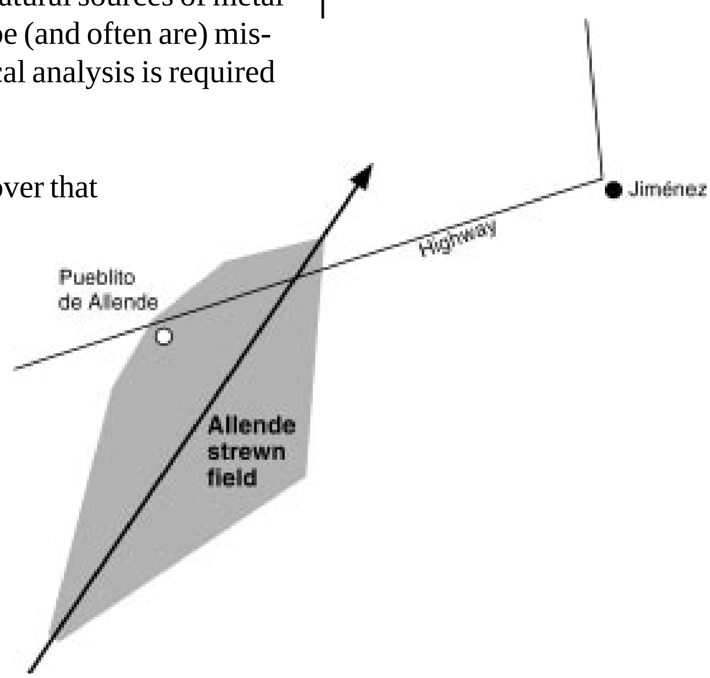
In their experiments, students will likely discover that good places to retrieve meteorites are surfaces that have no similar rocks, are very flat, have a contrasting background, and do not have thick vegetation. These conditions are best met on Earth by the polar ice cap in Antarctica, where in fact, thousands of meteorites have been found since 1969. Lots of meteorites are also found in deserts, especially in the Sahara and in southern Australia, where there are flat areas with few other rocks.

About This Lesson

Water balloons filled with flour and pebbles help students model the distribution of materials after meteorite impacts. The flour simulates the ejected crater material and the pebbles represent the meteorite fragments. Students will use the model to draw conclusions about where it would be easiest to find meteorites.

Vocabulary

meteorite, ejecta, terrain, velocity, impact



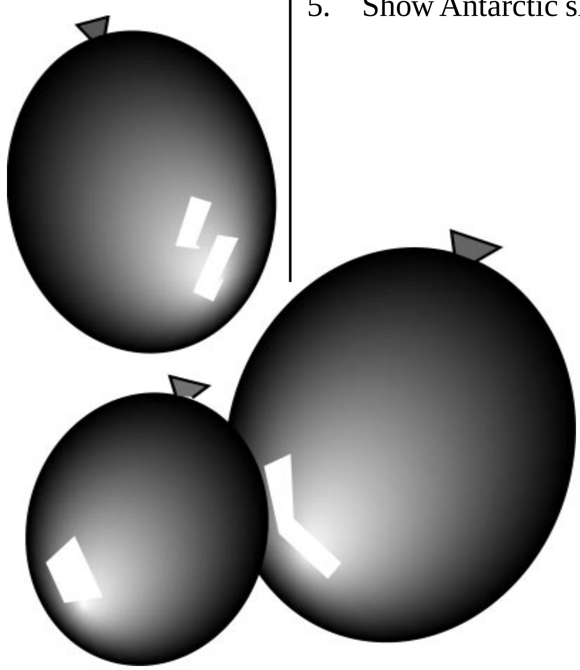
Materials

Per Student

- ❑ Student Procedure and Data Table *(pgs. 3.3-3.5)*
- ❑ 1 balloon *(round balloons work best)*
- ❑ 0.1 liter flour (1/2 cup)
- ❑ 10 to 20 small pebbles *(colored aquarium rocks work well)*
- ❑ graph paper

Per Group or Classroom

- ❑ water faucet to fill balloon
- ❑ funnel *(one per group)*
- ❑ measuring cup
- ❑ thin stick or skewer



Procedure

Advanced Preparation

1. Assemble materials.
2. Practice filling balloon with flour and check for appropriate locations to conduct impacts.

Classroom Procedure

1. Distribute Student Procedure and Data Table.
2. Discuss background and intent for activity (why and how).
3. Look at (or discuss) selected impact sites prior to predicting on Student Procedure.
4. Have students collect materials.
5. Follow Student Procedure.
6. Discuss results and lead to conclusions that Antarctica and deserts are likely the easiest places to find meteorites.

Extensions

1. Vary the exercise by using a variety of materials, chart all data, and rewrite the activity, making it more effective.
2. Dramatize the impact and scatter pattern of pebbles, using students as pebbles and doing the dramatization in slow motion.
3. On a world map have students predict where meteorites might easily be found.
4. Lesson 18 could be used to extend the Antarctic meteorite team information.
5. Show Antarctic slides (available from NASA, see page iv).

Lesson 3 — Searching for Meteorites

Student Procedure

Materials

Per Student

- ❑ Student Procedure and Data Table
- ❑ 1 balloon
- ❑ 0.1 liter flour (1/2 cup)
- ❑ 10 to 20 small pebbles
- ❑ graph paper

Per Group or Classroom

- ❑ water faucet
- ❑ funnel
- ❑ measuring cup
- ❑ thin stick or skewer

Procedure

Designate Groups

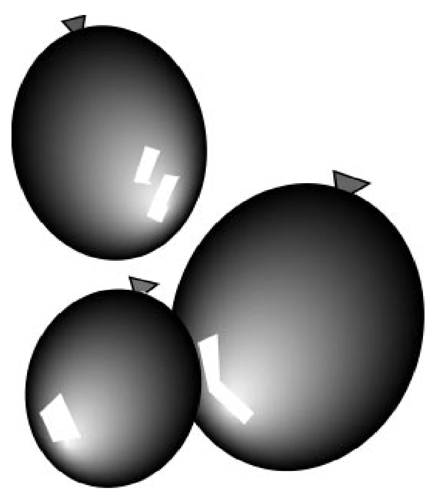
This activity is designed to be done in groups of 3-4 students. Although each student launches (throws) a balloon filled with water and pebbles, students should work as a group to choose areas, make predictions, record observations, and draw conclusions.

Designate Target Areas

Working with your teacher, find 3-4 locations of various surfaces where balloons filled with water and pebbles can be exploded. Surfaces commonly found at a school site are concrete pavement, long jump pit or other sand pit, grassy area, gravel, pebble, or shell surface, asphalt pavement, snow, ice, and water. Be sure to get permission to use all areas.

Classroom Procedure

1. Gather all equipment.
2. Choose or assign terrain targets for each student.
3. Record information on Data Table.
4. Make predictions and record on Data Table.



5. Place a funnel in the neck of a balloon. Fill balloon with approximately 0.1 liter (1/2 cup) of flour. Flour tends to pack, so it should be poured into the funnel slowly. A thin stick may be used to keep the flour flowing, but do not puncture the balloon.

6. Add pebbles one at a time, noting number of pebbles and color.

7. Fill balloon 3/4 full with water. **Do not shake the balloon. Be sure to tie the balloon securely.** This step must be done just before going outside to launch the balloons.

8. Launch balloons one at a time in designated areas. You may throw the balloon at an angle, lob them or throw them straight up so that they impact vertically. Remember to work as a group. Record observations at your launch site quickly then move to the next launch. When the group launches are complete, individuals return to their impact site to finish the sketch of their scatter pattern.

9. Clean up all balloon fragments and leave impact areas as clean as possible.

Searching for Meteorites: **Data Table**

Name: ______________________ **Other Team members:** ______________________
Date: ______________________ ______________________
____

Individual Launch Information

Balloon Filling

pebbles *(note number and color)* ______________________
water volume *(estimate)* ______________________
flour volume ______________________

predict number and colors of pebbles
that you will recover ______________________

Launch Site Description

(note terrain, estimate wind direction, and wind speed)

____

Launch Specifics

impact angle *(estimate)* ______________________
impact direction ______________________
impact velocity *(fast-slow)* ______________________

sketch impact site in the space at right

number(s) and colors of pebbles recovered ______________________
____

Team Launch Data

list different terrains below other variables *(predict if you think it will be easy or hard to find the pebbles)*		pebbles *# launched and colors*	pebbles *# recovered and colors*	pebbles *% recovered*	explain *(wind or height, etc.)*
example: ice	easy	8 2 red, 1 blue, 5 green	6 2 red, 1 blue, 3 green	75%	building blocked wind

Graph

Make a graph of the percentage of pebbles recovered from each impact surface. Note how the data compares to your predictions. Include data from different colors of pebbles if available.

Questions

Based on your data, which surface was the easiest for pebble recovery? Why?

Did this match your predictions?

What kind of land surface might be most productive for searching for meteorites? Why?

How is the scatter pattern affected: by the ground surface? by the angle of impact?

How might a scientist use this type of information to help locate meteorites?